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Art Unit: 1775

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner: Jennifer C. McNeil

Applicant: Purusottam Sahoo, et al

Serial No: 10/758,565

Filed: 01/15/04

Title: High Temperature Insulative Coating (XTR)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Sir:

This is an appeal from the Final Rejection dated October 18, 2005 of claims 1 to 14.

A check in the amount of $500.00 is enclosed herewith. Should any additional fees be required, please charge such to deposit account 03-0678.

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REAL PARTY IN INTEREST

The real party in interest is the assignee of record Sulzer Hickham Industries Inc. a Texas corporation having an office in LaPorte, Texas.

RELATED APPEALS

There are no related appeals and/or interferences.

STATUS OF CLAIMS

Claims 1 to 11 have been rejected.

STATUS OF AMENDMENTS

An Amendment After Final Rejection filed December 22, 2005 has been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

Independent Claim 1

The claimed subject matter of independent claim 1 is a thermal barrier coating for a substrate that comprises a MCrAlY bond coat, wherein M is at least one of Ni and Co, an intermediate crack resistant ceramic coating on the bond coat, and a vertically cracked top coat of yttria stabilized zirconia on the intermediate coat.

Dependent Claim 2

Claim 2 depends from claim 1 and requires the intermediate coating to have pores to resist crack propagation.

Dependent Claim 3

Claim 3 depends from claim 2 and requires the intermediate coating to include polyester.

Dependent Claim 4

Claim 4 depends from claim 1 and requires the intermediate coating to have a thickness of from 0.002 to 0.010 inch.

Dependent Claim 5

Claim 5 depends from claim 2 and requires the intermediate coating to have a thickness of from 0.004 to 0.006 inch.

Dependent Claim 6

Claim 6 depends from claim 2 and requires the bond coat to have a thickness of from 0.003 to 0.010 inch, the intermediate coating to have a thickness of from 0.002 to 0.006 inch and the top coat to have a thickness of from 0.005 to 0.045 inch.

Independent Claim 7

The claimed subject matter of independent claim 7 is a thermal barrier coating for a substrate that comprises a bond coat made of NiCoCrAlY, an intermediate crack resistant ceramic coating on the bond coat having a thickness of from 0.002 to 0.010 inch, and a vertically cracked top coat of yttria stabilized zirconia on the intermediate coat.

Dependent Claim 8

Claim 8 depends from claim 7 and requires the bond coat to contain a reactive element selected from the group consisting of hafnium and silicon.

Independent Claim 9

The claimed subject matter of independent claim 7 is a coated substrate that comprises a substrate, a bond coat on the substrate comprised of a high temperature MCrAlY wherein M is at least one of Ni and Co and having a thickness of from 0.003 to 0.010 inch, an intermediate crack resistant ceramic coating containing yttria stabilized zirconia on the bond coat of a thickness of from 0.002 to 0.006 inch, and a vertically

cracked top coat on the bond coat comprised of high temperature yttria stabilized zirconia of a thickness of from 0.005 inches to 0.045 inches.

Dependent Claim 10

Claim 10 depends from claim 9 and requires the substrate to be an inner shroud cover plate.

Dependent Claim 11

Claim 11 depends from claim 9 and requires the substrate to be one of a turbine rotating blade, a turbine bucket, a stationary vane and a nozzle segment.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 1, 2, 4, 5 and 7 are anticipated by Subramanian (US 6,716,539) under 35 U.S.C. 102(e).

Whether claims 6 and 8-11 are unpatentable over Subramanian (US 6,716,539) in view of Vine (US 4,936,745) under 35 U.S.C. 103.

Whether claim 3 is unpatentable over Subramanian (US 6,716,539) in view of Subramanian (US 6,703,137)under 35 U.S.C. 103.

ARGUMENT

The top layer 22 of Subramanian '539 is not a vertically cracked top coat

Each of the independent claims 1 and 7 require a thermal barrier coating to comprise, inter alia, "a vertically cracked top coat of yttria stabilized zirconia on said intermediate coat". Subramanian '539 does not have a vertically cracked top coat.

Subramanian '539 describes a thermal barrier coating 12 formed of a first layer of insulating material 20 and a second layer of insulating material 22 with the properties of the two layers being different.(column 3, lines 58-61). Both layers 20,22 may be 6-8 weight percent yttria stabilized zirconia. (column 4, lines 1-3).

Further, the second layer 22 of Subramanian '539 has a generally columnar-grain structure wherein columns of material 24 are separated by a respective plurality of gaps 26. (column 4, lines 22 to 24). The material 24 between the gaps 26 is made of one or more grains, with each grain having a high aspect ratio of height/width in the range of 500-400 or preferably around 200. The number of grains between adjacent gaps 26 may be in the range of 5-300 depending upon the deposition process with each grain having a width of from about 1-3 microns. The width of each gap may be in the range of 1-2 microns.

A vertically cracked top coat of YSZ has cracks that are visible only under a microscope and typically do not have a dimension attached thereto. An analogy is made to a cracked glass or a cracked windshield, i.e. only the length dimension is applied since the "width" is microscopically thin. Accordingly, one skilled in the art would not consider the gaps 26 of Subramanian '539 as cracks.

In order to minimize the possibility of sintering of adjacent columns 24, Subramanian '539 teaches that a sinter-inhibiting material 30 may be deposited on the second layer 22 between adjacent columns. Since the material 30 is applied as shown in the drawing to extend along both sides of each gap 26, it is clear that a gap 26 is not a crack. That is to say, a crack does not provide a sufficient gap for the opposite sides

of the crack to be coated. For this reason alone, Subramanian '539 teaches that the gaps 26 are not cracks.

Subramanian '539 teaches that the first layer 20 may have a degree of porosity sufficiently high to arrest the propagation of a crack originating at the generally vertical gaps 26. For this additional reason, Subramanian '539 teaches that the gaps 26 are not cracks.

Subramanian '539 is clearly concerned with a process for obtaining gaps in a coating surface and not in a process for forming a thermal barrier coating with vertical cracks.

In view of the above, a rejection of claim 1 as being anticipated by Subramanian '539 is not warranted pursuant to the provisions of 35 USC 102. Similarly, a rejection of claim 7 as being anticipated by Subramanian '539 is not warranted pursuant to the provisions of 35 USC 102.

Vine does not teach a vertically cracked top coat

Vine is cited to show a bond coating for a thermal barrier coating system comprising MCrAlY which may include Hf and Si. Accordingly, any modification of Subramanian '539 with the teachings of Vine would not result in a thermal barrier coating comprising, inter alia, "a vertically cracked top coat of yttria stabilized zirconia on said intermediate coat" as claimed. For this reason alone, a rejection of claims 6 and 8 – 11 as being unpatentable over Subramanian (US 6,716,539) in view of Vine (US 4,936,745) is not warranted under 35 U.S.C. 103.

Subramanian '137 does not teach a vertically cracked top coat

Subramanian '137 is cited to show a porous bottom layer similar to that of Subramanian '539 and with a porosity formed by providing polyester in the layer. Accordingly, any modification of Subramanian '539 with the teachings of Subramanian '137 would not result in a thermal barrier coating comprising, inter alia, "a vertically cracked top coat of yttria stabilized zirconia on said intermediate coat" as claimed. For this reason alone, a rejection of claim 3 as being unpatentable over Subramanian '539 in view of Subramanian '137 is not warranted under 35 U.S.C. 103.

Of note, claim 1 had also been rejected in the Final Rejection of October 18, 2005 as being anticipated by Subramanian '137 with the Examiner considering the gaps 28 described therein to be "cracks". Issue was taken in this respect and Applicants noted in the Amendment after Final Rejection of December 22, 2005 that the gaps 28 of Subramanian '137, having a width of no more than 50 microns and preferably no more than 25 microns (column 5, lines 60 to 62) and a gap center line spacing of 1000 microns, would not be considered as cracks. This rejection was withdrawn by the Advisory Action of January 9, 2006.

Claims 2 – 6 depend from claim 1 and are believed to be allowable for similar reasons.

Claim 8 depends from claim 7 and is believed to be allowable for similar reasons.

Claims 10 and 11 depend from claim 9 and are believed to be allowable for similar reasons.

SUMMARY

For the reasons set forth above, the Final Rejection of claims 1 to 11 should be reversed.

The application is believed to be in condition for allowance and such is respectfully requested.

FIRST CLASS CERTIFICATE

I hereby certify that this correspondence is being deposited today with the U.S. Postal Service as First Class Mail in an envelope addressed to:

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3-21-06

Francis C. Hand, Esq. **Date**

Respectfully submitted,

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CLAIMS APPENDIX

1. A thermal barrier coating for a substrate, said coating comprising

a MCrAlY bond coat wherein M is at least one of Ni and Co;

an intermediate crack resistant ceramic coating on said bond coat; and

a vertically cracked top coat of yttria stabilized zirconia on said intermediate coat.

2. A thermal barrier coating as set forth in claim 1 wherein said intermediate coating includes a plurality of pores therein to resist crack propagation.

3. A thermal barrier coating as set forth in claim 2 wherein said intermediate coating includes polyester.

4. A thermal barrier coating as set forth in claim 1 wherein said intermediate coating has thickness of from 0.002 to 0.010 inch.

5. A thermal barrier coating as set forth in claim 2 wherein said intermediate coating has a thickness of from 0.004 to 0.006 inch.

6. A thermal barrier coating as set forth in claim 2 wherein said bond coat has a thickness of from 0.003 to 0.010 inch, said intermediate coating has a thickness of from 0.002 to 0.006 inch and said top coat has a thickness of from 0.005 to 0.045 inch.

7. A thermal barrier coating for a substrate, said coating comprising

a bond coat made of NiCoCrAlY;

an intermediate crack resistant ceramic coating on said bond coat having a thickness of from 0.002 to 0.010 inch; and

a vertically cracked top coat of yttria stabilized zirconia on said

intermediate coat.

8. A thermal barrier coating as set forth in claim 7 wherein said bond coat contains a reactive element selected from the group consisting of hafnium and silicon.

9. A coated substrate comprising

a substrate;

a bond coat on said substrate comprised of a high temperature MCrAlY wherein M is at least one of Ni and Co and having a thickness of from 0.003 to 0.010 inch,

an intermediate crack resistant ceramic coating containing yttria stabilized zirconia on said bond coat of a thickness of from 0.002 to 0.006 inch; and

a vertically cracked top coat on said bond coat comprised of high temperature yttria stabilized zirconia of a thickness of from 0.005 inches to 0.045 inches.

10. A coated substrate as set forth in claim 9 wherein said substrate is an inner shroud cover plate.

11. A coated substrate as set forth in claim 9 wherein said substrate is one of a turbine rotating blade, turbine bucket, stationary vane and nozzle segment.

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